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REFER TO: IMH-R

March 24, 1955

Dr. Rosalind Franklin
Birkbeck College
University of London
21 Torrington Square
London W.C. 1, England

Dear Rosalind:

I am terribly sorry to have made a "butch" in measuring the birefringence of these films. Indeed, the birefringence is - .002 instead of + .002. This mistake is all the more interesting since the introduction of RNA into TMV changes it from negative to positive birefringence, while the RNA itself, paradoxically, has a negative birefringence. How can it be that introducing a negatively birefringent molecule into a protein shell, which itself is negatively birefringent, produces something which is positively birefringent? Here is a conundrum, indeed.

I found your manuscript quite interesting. I believe that your explanation is correct, namely, that the introduction of further water into these protein films does, in fact, pull apart the helix so that the repeat distance changes. I think that one can make an analogy between the photographs which you have obtained at different humidities with the Perutz photographs of hemoglobin. There, by changing the salt concentration, he was able to move the molecule in and out over different distances, and was thereby able to sample the transform of one molecule at different points due to the alteration of the latter function. Here, by changing the water in the nucleic acid from protein helix, one is able to make the helix expand and contract, thereby sampling the transform at different layer line spacings. The transform in this case is not the transform of the individual monomeric units, but rather something which is close to the transform of this monomeric unit rotated around the axis.
It seems, from your description, that the protein is able to go from a state which has roughly 37 or so units in three turns ~~covering~~ repeating in

68 angstroms into something which has roughly two turns in 45 angstroms perhaps with 25 units or so in this repeat distance. In other words, small changes in the positioning of the helical coil changes the layer line spacings in this way. It is apparently just an accident that the photographs that I had have the same spacing as TMV, implying that the protein, at this hydration packed in a manner which is similar to the arrangement of the protein in the TMV. [redacted], On introducing more water, this apparently no longer holds. At any rate, I am going to test this by seeing whether I can take one of these films which gave me the very bad pictures which you saw here, and whether increasing [redacted] humidity in this film will [redacted] produce changes which you have described. I think that the demonstration of these changes makes the whole problem much more interesting, in that it [redacted] the possibility of obtaining the complete transform for the cylindrically symmetric monomeric units throughout reciprocal space in a way similar to what was done with the hemoglobin.

Newmark has sent me more of the TMV material and I hope to make [redacted] films [redacted]. However, the first batch that he sent me proved to be unpolymerized, and so I am unable to do anything at the moment. However, I hope to be able to do more work here in the short future.

My plans regarding the spring are still somewhat indefinite, and I'll let you know more about them later.

Sincerely yours,

Alex

Alexander Rich, M.D.